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**Abstract**

# NORTH AMERICAN EXPERIENCE IN THE RELEASE OF LOW-LEVEL WASTE TO RIVERS AND LAKES

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The controlled release of effluents bearing residual amounts of radionuclides became virtually inevitable nearly two decades ago when man began to produce radioactive substances in substantial amounts. In North America the dominant sources have been the large atomic-energy sites at Hanford, Oak Ridge, and Savannah River in the United States, and Chalk River in Canada. The kinds and quantities of radioactive wastes from these sites are quite different, however, because of the basic differences in major facilities.

Releases have ranged from a few curies of fission products to several thousands of curies of neutron-activation products each day. By contrast, the dozen or more power reactors now operating in North America release, at most, a few millicuries each day in liquid effluents.

Attention devoted to routine surveillance at each site has corresponded with the magnitude of the releases and the potential for radiation exposure of people and other life forms. In addition, the diverse nature of the radioactive wastes, coupled with the wide range of physical, chemical, and biological conditions characteristic of the surface waters at the several sites has permitted research that provides a broad knowledge of the consequences of introducing radioactive materials into aquatic environments and of the ecological relationships that prevail.

This paper will cover the considerable maturity gained during the past five years in these studies, emphasizing several factors of fundamental importance to waste management that have come into sharper focus. These include:

1) Substantial advances in estimating radiation dose to the general public from multiple environmental sources.

2) Identification of the particular environmental pathways that may lead to significant radiation exposure from sites for disposal of liquid waste.

3) Accounting for the quantities of radionuclides present in the water, sediments, and biota by material-balance methods.

4) Notable improvements in instrumentation, including whole-body counters.

5) The very real significance of local variables, such as water quality, and the nature of sediments on the fate of radionuclides.

Although a great variety of fission and neutron activation products have entered lakes and streams, only a few of them have thus far warranted close study because of their active potential for human exposure.

For the most part, fission products, including Sr-90, Ru-106, Ce-144, and I-131 have not been transmitted through aquatic food chains in a manner that would make fish flesh a greater source of exposure to man than the drinking of the water in which the fish were grown. A few activation products, notably P-32 and Zn-65, are important exceptions. Tritium may eventually be the nuclide of greatest significance in drinking water near fuel-reprocessing plants.

A gratifying outcome of the studies that have treated radiation exposure from multiple environmental sources is confirmation that the total dose to the public has been well within appropriate limits at all sites. The general tenor of the environmental studies indicates sound and continuous control of the relevant effluents. The studies should provide a methodology for assuring continued reliable control of liquid effluents associated with the expected growth of the nuclear-power industry in North America.